

US009637066B2

(12) United States Patent Abe et al.

(54) GLASS CHOPPED STRAND MAT, METHOD FOR PRODUCING SAME, AUTOMOTIVE MOLDED CEILING MATERIAL, AND METHOD FOR PRODUCING SAME

(71) Applicant: **NIPPON ELECTRIC GLASS CO., LTD.,** Shiga (JP)

(72) Inventors: **Jiro Abe**, Shiga (JP); **Satoshi Nishie**, Shiga (JP); **Kiyomasa Sugimoto**, Shiga

(73) Assignee: **Nippon Electric Glass Co., Ltd.**, Shiga (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 132 days.

(21) Appl. No.: 14/237,581

(22) PCT Filed: Dec. 5, 2012

(86) PCT No.: **PCT/JP2012/081475** § 371 (c)(1), (2) Date: **Feb. 7, 2014**

(87) PCT Pub. No.: **WO2013/094402**

(87) PCT Pub. No.: **WO2013/094402** PCT Pub. Date: **Jun. 27, 2013**

(65) Prior Publication Data
US 2015/0322600 A1 Nov. 12, 2015

(30) Foreign Application Priority Data

(51) Int. Cl. D04H 1/4218 (2012.01) B60R 13/02 (2006.01)

(52) **U.S. Cl.**CPC *B60R 13/0212* (2013.01); *B32B 5/245* (2013.01); *D04H 1/4218* (2013.01); (Continued)

(Continued)

Dec. 20, 2011 (JP) 2011-278988

(10) Patent No.: US 9,637,066 B2 (45) Date of Patent: May 2, 2017

(58) Field of Classification Search

CPC ... B32B 5/24–5/245; D04H 1/70–1/76; D04H 1/4218; B60R 13/0212–13/0231 See application file for complete search history.

(56) References Cited

U.S. PATENT DOCUMENTS

5,041,178 A 8/1991 Kielmeyer et al. 6,008,147 A 12/1999 Jaffee (Continued)

FOREIGN PATENT DOCUMENTS

JP 05247811 9/1993 JP 2002-88627 3/2002 (Continued)

OTHER PUBLICATIONS

PCT/JP2012/081475; PCT International Search Report and Written Opinion of the International Searching Authority dated Mar. 1, 2013.

(Continued)

Primary Examiner — Prashant J Khatri (74) Attorney, Agent, or Firm — Renner, Otto, Boisselle & Sklar, LLP

(57) ABSTRACT

Provided is a high-quality and high-functionality glass chopped strand mat which is applicable to recent automotive molded ceiling materials which have excellent design and reduced weights. The glass chopped strand mat is a glass chopped strand mat (M) produced by forming glass chopped strands (S) into a sheet, in which the ratio of a tensile strength in a width direction to a tensile strength in a longitudinal direction (the width direction/the longitudinal direction) of the glass chopped strand mat (M) is at least 0.73 and less than 1.00, and the tensile strength in the width direction is not less than 80 N as measured in a tensile rupture test conducted according to the Japanese Industrial (Continued)

